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10/526,489	03/04/2005	Yasuhisa Kitahara	023971-0544	1853

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EXAMINER	
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3748	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/526,489	KITAHARA, YASUHISA	
	Examiner	Art Unit	
	LOREN C. EDWARDS	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-14 and 16-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-14 and 16-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 March 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/20/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Amendment filed on 2/8/08 has been entered. Claims 1 and 15 have been canceled; and claim 2, 6, 30, and 32 have been amended. Overall, claims 2-14, and 16-36 pending in the application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

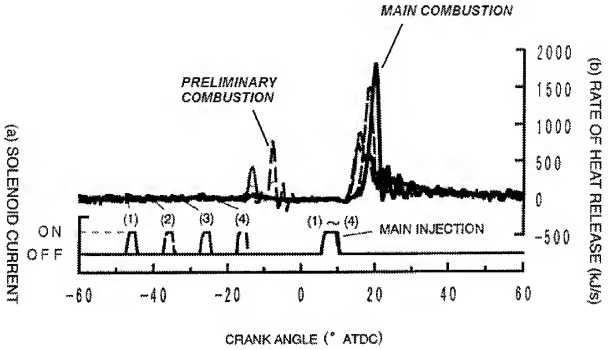
3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 2-4, 7-15, 17, 18, 27-30, and 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (U.S. 6,688,279) in view of Salvat et al. (U.S. 6,412,276). Ishikawa discloses a combustion control apparatus for an internal combustion engine, comprising: a combustion controlling actuator (Ishikawa; Fig. 1, Nos. 9 and 26) to cause main combustion (Ishikawa; Modified Fig. 3, Main Combustion), and to cause preliminary combustion (Ishikawa; Modified Fig. 3,

Preliminary Combustion) prior to the main combustion; and a controller (Ishikawa; Fig. 1, No. 26) to control fuel injection to produce the preliminary combustion (Ishikawa; Fig. 3, Nos. 3 or 4), and to control fuel injection to start the main combustion after an end of the preliminary combustion (Modified Fig. 3, Main Combustion after Preliminary Combustion); wherein the combustion controlling actuator includes a fuel injector (Ishikawa; Fig. 1, No. 9) to inject fuel directly into a combustion chamber of the engine; and the controller is configured to perform a preliminary fuel injection to produce the preliminary combustion at or near top dead center (Ishikawa; Fig. 3, No. 4 – near TDC), and to perform a main fuel injection to start the main combustion after the preliminary combustion is finished (Ishikawa; Modified Fig. 3, Main Combustion) such that a premixed combustion process is predominant in the main combustion (Ishikawa; Modified Fig. 3, Main Combustion larger than Preliminary Combustion), the preliminary fuel injection being immediately prior to the main fuel injection (Ishikawa; Modified Fig. 3, Main Combustion immediately after Preliminary Combustion), and wherein the controller is configured to perform the preliminary fuel injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Ishikawa; Fig. 4). Ishikawa fails to specifically disclose wherein there is an exhaust purifier in an exhaust passage of the internal combustion engine. Salvat discloses a particulate filter (Salvat; Fig. 1, No. 8) for an internal combustion engine. It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the

system of Salvat in the system of Ishikawa for the advantage of reduced particulate emission.



Ishikawa Modified Fig. 3 – Added reference notations

4. With regards to claim 3, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control the combustion controlling actuator in a split combustion mode (Salvat; Fig. 3) by controlling the fuel injection to produce the preliminary combustion at or near top dead center, and by controlling the fuel injection to start the main combustion after the end of the preliminary combustion when a split combustion request is produced to bring the exhaust purifier to an operative state (Salvat; Col. 2, Line 61 – Col. 3, Line 20).

5. With regards to claim 4, the modified Ishikawa discloses the combustion control apparatus of claim 3, as described above, and further wherein the controller is configured to control the combustion controlling actuator normally in a normal combustion mode (Salvat; Fig. 2), and to change over a combustion control mode from the normal combustion mode to the split combustion (Salvat; Fig. 3) mode in response to the split combustion request produced in accordance with a condition of the exhaust purifier (Salvat; Col. 2, Lines 47-67).

6. With regards to claim 7, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to delay the start of the main combustion (Ishikawa; Fig. 3, Nos. 3 and 4).

7. With regards to claim 8, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform the main fuel injection (Ishikawa; Fig. 3, Main Injection) for the main combustion at a timing to start the main combustion after an end of a heat releasing process of the preliminary combustion (Ishikawa; Modified Fig. 3, Main Combustion after Preliminary Combustion).

8. With regards to claim 9, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to start the main fuel injection for the main combustion at a timing to inject fuel in a state in which the flame subsides in the combustion chamber, to prevent diffusive combustion process in the main combustion (Ishikawa; Modified Fig. 3, Main Combustion occurs after the end of the Preliminary Combustion).

9. With regards to claim 10, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control a preliminary fuel injection quantity of the preliminary fuel injection to a smaller quantity required to increase an incylinder temperature in the combustion chamber, and to make a main fuel injection quantity of the main combustion greater than the preliminary fuel injection quantity, to produce engine torque with the main combustion (Ishikawa; Modified Fig. 3, Main Combustion larger than Preliminary Combustion).

10. With regards to claim 11, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control a preliminary fuel injection quantity for the preliminary fuel injection equal to a fuel quantity required to make an incylinder temperature in the combustion chamber at a fuel injection timing of the main combustion, higher than or equal to an auto ignition temperature enabling spontaneous ignition in the combustion chamber (Ishikawa; Fig. 3; Col.10, Lines 9-29).

11. With regards to claim 12, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein an amount of retard of a combustion start timing of the main combustion with respect to a combustion start timing of the preliminary combustion is equal to or greater than 20° in crank angle (Ishikawa; Fig. 3, No. 3).

12. With regards to claim 13, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein an amount of retard of a

combustion end timing of the main combustion with respect to compression top dead center is equal to or greater than 50° in crank angle (Salvat; Col. 3, Lines 20-29).

13. With regards to claim 14, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform the preliminary fuel injection for the preliminary combustion during a compression stroke (Ishikawa; Modified Fig. 3 – Preliminary Combustion occurs before TDC).

14. With regards to claim 17, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control an exhaust gas temperature of the engine by varying the fuel injection timing of the man combustion (Salvat; Fig. 2; Fig. 3; Col. 3, Line 1-29).

15. With regards to claim 18, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control the main combustion so as to hold torque produced by the engine constant (Salvat; Col. 2, Lines 51-55).

16. With regards to claim 27, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform a plurality of preliminary fuel injections to cause a plurality of heat releasing processes for the preliminary combustion prior to the main combustion so that at least one of the heat realizing processes of the preliminary combustion is produces at or near top dead center (Salvat; Col. 3, Lines 1-29).

17. With regards to claim 28, the modified Ishikawa discloses the combustion control apparatus of claim 27, as described above, and further wherein the controller is configured to perform a plurality of preliminary fuel injections to cause a plurality of heat releasing processes for the preliminary combustion in a low engine load region (Salvat; Col. 3, Lines 1-29).

18. With regards to claim 29, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the combustion control apparatus further comprises the internal combustion engine which is a diesel engine (Ishikawa; Col. 1, Lines 15-18).

19. With regards to claim 30, the modified Ishikawa, as described in rejecting claim 2 above, discloses a combustion control process for an internal combustion engine (Ishikawa; Fig. 1, No. 1) provided with an exhaust purifier (Salvat; Fig. 1, No. 8) in an exhaust passage of the internal combustion engine, the combustion control process comprising: controlling fuel injection to produce preliminary combustion in an engine cycle by performing a preliminary fuel injection to produce the preliminary combustion at or near top dead center (Ishikawa; Modified Fig. 3, Preliminary Combustion); and controlling fuel injection to start main combustion after an end of the preliminary combustion in the engine cycle by performing a main fuel injection such that a premixed combustion process is predominant in the main combustion (Ishikawa; Modified Fig. 3, Main Combustion), the preliminary fuel injection being immediately prior to the main fuel injection (Ishikawa; Modified Fig. 3, Main Combustion immediately after Preliminary Combustion), the preliminary fuel injection being performed at such a timing as to cause

a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Ishikawa; Fig. 4).

20. With regards to claim 33, the modified Ishikawa discloses the combustion control process of claim 30, as described above, and further wherein the preliminary fuel injection for the preliminary combustion is performed during a compression stroke (Ishikawa; Modified Fig. 3 – Preliminary Combustion occurs before TDC).

21. With regards to claim 34, the modified Ishikawa discloses the combustion control process of claim 30, as described above, and further wherein the preliminary fuel injection is performed at such a timing as to cause a heat releasing process of the preliminary combustion to start before a compression top dead center and to end after the compression top dead center (Ishikawa; Fig. 4).

22. With regards to claim 35, the modified Ishikawa discloses the combustion control process of claim 30, as described above, and further wherein the start of the main combustion is delayed with respect to the preliminary combustion (Ishikawa; Modified Fig. 3 – Preliminary Combustion occurs before Main Combustion).

23. Claims 5, 6, 19, 31, 32, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa, as applied to claim 1 above, and further in view of Kamiya et al. (U.S. 4,685,290). The modified Ishikawa discloses the combustion control apparatus of claim 4, but fails to specifically describe wherein the controller is configured to estimate a condition of the exhaust purifier. Kamiya discloses an engine control with the function to eliminate minute particles in the exhaust gas that estimates the amount of particulate trapped in a filter and uses this to trigger the regeneration of

the filter (Kamiya; Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the exhaust purifier condition estimator as taught by Kamiya in the system of Ishikawa for the advantage of efficient regeneration.

24. With regards to claim 6, the modified Ishikawa discloses the combustion control apparatus of claim 5, as described above, and further wherein the combustion control apparatus comprises a condition sensor (Kamiya; Fig. 2, No. 23) to collect information needed to determine the estimated condition of the exhaust purifying section.

25. With regards to claim 19, the modified Ishikawa discloses the combustion control apparatus of claim 3, as described above, and further wherein the exhaust purifier includes a particulate filter (Salvat; Fig. 1, No. 8) to collect exhaust particulate matter, and the controller is configured to produce the split combustion request (Salvat; Col. 2, Lines 61-67) in accordance with an estimated particulate matter quantity (Kamiya; Abstract) of the particulate matter accumulated in the particulate filter, to increase an exhaust gas temperature for auto oxidation of the particulate matter in the particulate filter.

26. With regards to claim 31, the modified Ishikawa discloses the combustion control process of claim 30, as described above, and further including: determining an estimated condition of the exhaust purifier (Kamiya; Abstract); producing a split combustion request in accordance with the estimated condition of the exhaust purifier (Salvat; Col. 2, Lines 61-67); changeover a combustion control mode from a normal mode to a split combustion mode in response to the split combustion request (Salvat;

Col. 2, Lines 47-67); and controlling the fuel injection to produce the preliminary combustion and the fuel injection to start the main combustion after the end of the preliminary combustion in the split combustion mode (Salvat; Figs. 3 and 4).

27. With regards to claim 32, the modified Ishikawa, as described in rejected claim 5 above, discloses a combustion control apparatus for an internal combustion engine comprising: means for determining an estimated condition (Kamiya; Abstract) of an exhaust purifier (Salvat; Fig. 1, No. 8) in an exhaust passage of the internal combustion engine; means for producing a split combustion request in accordance with the estimated condition of the exhaust purifier (Salvat; Col. 2, Lines 61-67); and means for controlling fuel injection to the engine in a split combustion mode in response to the split combustion request by controlling fuel injection to perform a preliminary fuel injection to start main combustion after an end of the preliminary combustion such that a premixed combustion process is predominant in the main combustion (Salvat; Figs. 3 and 4), the preliminary fuel injection being immediately prior to the main fuel injection (Salvat; Fig. 3, I'2 before I'3), the means for controlling the fuel injection including means for performing the preliminary injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Salvat; Figs 3 and 4), the means for controlling the fuel injection including means for performing the preliminary fuel injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Ishikawa; Fig. 4).

28. With regards to claim 36, the modified Ishikawa discloses the combustion control apparatus of claim 32, as described above, and further wherein the means for controlling the fuel injection to the engine in the split combustion mode includes means for decreasing a percentage of diffusive combustion in the main combustion and instead increasing a percentage of premixed combustion in the main combustion by delaying a start of the main combustion after the end of the preliminary combustion (Ishikawa; Fig. 3).

29. Claims 16, 20, 21, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa in view of Sasaki et al. (U.S. 6,804,952). With regards to claim 20, the modified Ishikawa discloses the combustion control apparatus of claim 3, as described above, but fails to specifically describe the exhaust purifier including a NOx trap catalyst device. Sasaki discloses a catalyst warm up control for diesel engines that uses a NOx trap catalyst (Sasaki; Col. 4, Lines 4-20) in an exhaust track to reduce NOx emissions, and further uses a split injection technique to rapidly warm this catalyst to operating temperature (Sasaki; Col. 2, Lines 18-33). It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the NOx trap catalyst of Sasaki in the system of Salvat for the advantage of reducing NOx emissions.

30. With regards to claim 21, the modified Ishikawa discloses the control apparatus of claim 20, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with an estimated NOx quantity of

the NOx trapped in the NOx trap device (Sasaki; Col. 6, Lines 37-48; Salvat; Col. 2, Line 61 – Col. 3, Line 7).

31. With regards to claim 26, the modified Ishikawa discloses the combustion control apparatus of claim 3, as described above, and further wherein the exhaust purifier includes an NOx trap catalyst device (Sasaki; Col. 4, Lines 4-20) to trap NOx in a lean operation of the engine, and the controller is configured to produce the split combustion request at a time to warm up the NOx trap device (Sasaki; Col. 2, Lines 18-34).

32. With regards to claim 16, the modified Ishikawa discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to vary at least one of a fuel injection quantity and a fuel injection timing of the preliminary fuel injection for the preliminary combustion in accordance with a compression end temperature in the combustion chamber at an end of a compression stroke (Sasaki; Col. 8, Line 66 – Col. 9, Line 10; Col. 9, Line 52 – Col. 10, Line 2).

33. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa, as applied to claim 3 above, and further in view of Kitahara (U.S. 6,796,118). With regard to claim 23, the modified Ishikawa discloses the combustion control apparatus of claim 3, as described above, but fails to specifically disclose the exhaust purifier including an NOx trap device or a controller configured to produce a split combustion when the NOx trap needs to be purged of sulfur. Kitahara discloses an exhaust gas purification system and method for an internal combustion engine that disposes a NOx trap in an exhaust track (Kitahara; Fig. 1, No. 13) and performs a split injection when the trap is in a state of sulfur poisoning (Kitahara; Col. 4, Lines 10-38). It

would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the NOx trap of Kitahara in the system of Ishikawa for the advantage of reducing NOx emissions.

34. With regards to claim 24, the modified Ishikawa discloses the combustion control apparatus of claim 23, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with an estimated sulfur content quantity of the sulfur content trapped in the NOx trap device (Kitahara; Col. 4, Lines 10-38; Fig. 2, Step 4).

35. With regards to claims 22 and 25, the modified Ishikawa discloses the combustion control apparatus of claims 20 and 23, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with a distance traveled by a vehicle powered by the internal combustion engine (Kitahara; Col. 4, Line 57 – Col. 5, Line 6).

Response to Arguments

36. Applicant's arguments filed 2/8/08 have been fully considered but they are not persuasive. Specifically, Applicant has argued that Ishikawa fails to disclose "performing fuel injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center." The examiner respectfully disagrees. Ishikawa's Figure 4 shows a slight heat release which starts before and continues past top dead center.

Conclusion

37. This is an RCE of applicant's earlier Application No. 10/526489. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LOREN C. EDWARDS whose telephone number is (571)272-2756. The examiner can normally be reached on M-TH 5:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Denion can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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